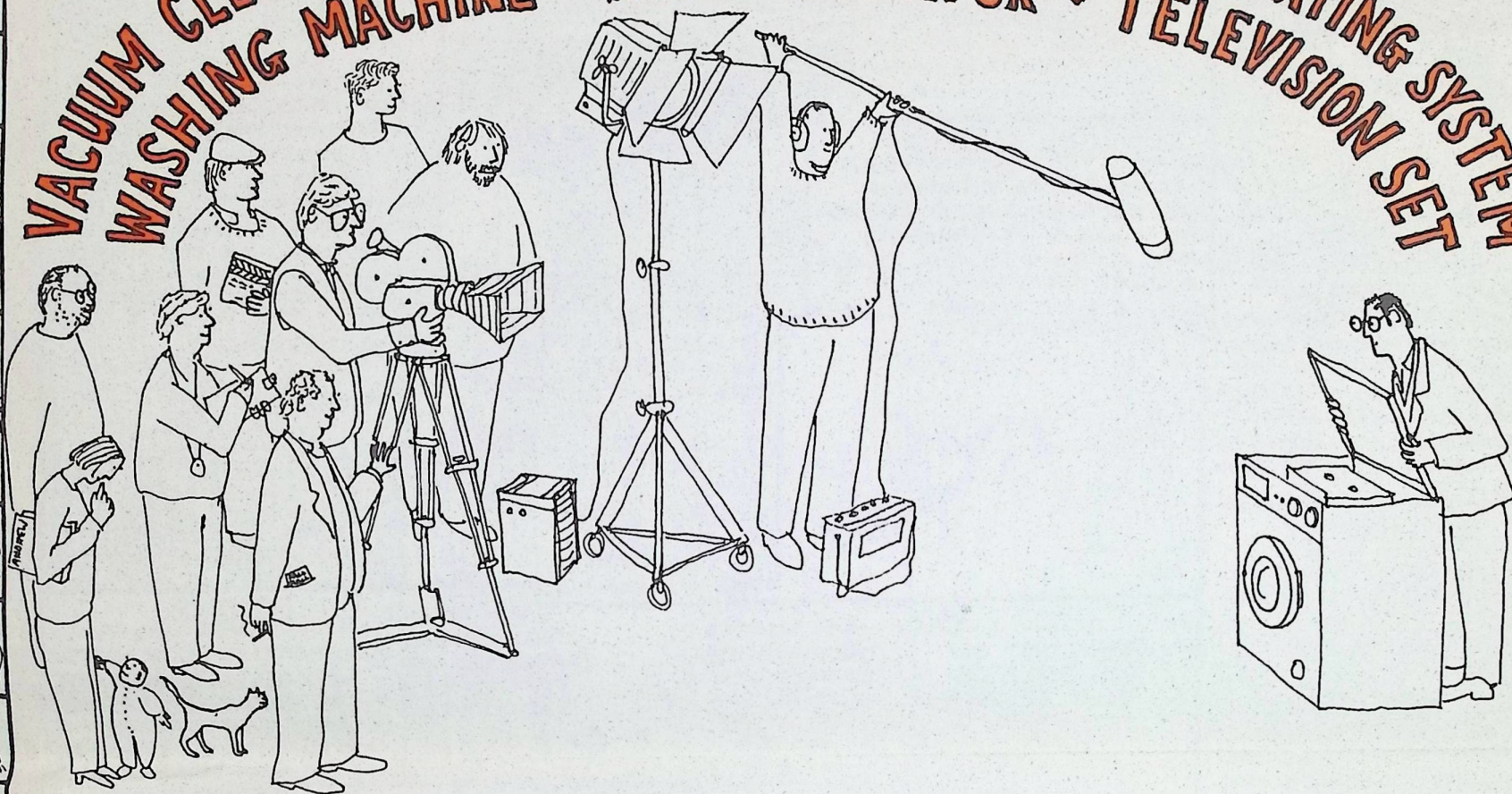


# THE SECRET LIFE

OF THE

VACUUM CLEANER • SEWING MACHINE • CENTRAL HEATING SYSTEM  
WASHING MACHINE • REFRIGERATOR • TELEVISION SET



THIS SERIES DEVELOPED FROM THE CARTOON STRIP 'THE RUDIMENTS OF WISDOM' WHICH I DID FOR THE OBSERVER COLOUR MAGAZINE FOR 14 YEARS. I PARTICULARLY ENJOYED DOING THE CARTOONS ABOUT VERY ORDINARY THINGS THAT PEOPLE USUALLY TAKE FOR GRANTED. - LIKE THE HOUSEHOLD MACHINES IN THIS SERIES. I TRAINED AS AN ENGINEER &, BESIDES DRAWING CARTOONS, I ALSO MAKE MECHANICAL SCULPTURES & PUBLIC CLOCKS (LIKE THE WATER CLOCK IN COVENT GARDEN). MY OWN CREATIONS QUITE OFTEN INCORPORATE PARTS OF HOUSEHOLD MACHINES & THIS IS HOW I CAME TO BE INTERESTED IN THEM.

I OFTEN USE PARTS RESCUED FROM SCRAPYARDS AND SURPRISINGLY, MOST OF THEM STILL WORK PERFECTLY. MOST OF THE EXPERIMENTS IN THE SERIES WERE MADE FROM SCRAP MACHINES, PARTLY FOR CONVENIENCE, BUT PARTLY FOR MORE IDEOLOGICAL REASONS. THE OBSOLESCENCE OF ALL MODERN CONSUMER GOODS FASCINATES ME - I'M HALF HORRIFIED BY ALL THE WASTE & HALF EXCITED BY THE POTENTIAL OF THIS VAST NEW RESOURCE.

ALTHOUGH I DISLIKE THE DISPOSABLE WAY HOUSEHOLD MACHINES ARE MADE, I STILL CAN'T HELP ADMIRING THEIR INGENUITY. THEY ARE NOW SO AUTOMATIC & MAINTENANCE FREE THAT PEOPLE CAN USE THEM WITHOUT NEEDING TO KNOW ANYTHING MUCH ABOUT HOW THEY WORK. BUT I THINK

THERE REMAINS A SORT OF CURIOSITY ABOUT WHAT GOES ON INSIDE & THIS IS WHAT I HOPE I MIGHT AWAKEN BY THIS TV. SERIES.

THE PROGRAMMES THEMSELVES CONTAIN LOTS OF EXPERIMENTS & DEMONSTRATIONS, SOMETIMES QUITE BIZARRE & SPECTACULAR, BASED ON THE WORKING PARTS OF THE MACHINES. FOR INSTANCE, SAWING A SEWING MACHINE IN HALF & FILMING THE BOTTOM BOBBIN IN SLOW-MOTION MAKES IT QUITE OBVIOUS HOW THE STITCHES ARE FORMED. THIS BOOKLET DOES ATTEMPT TO 'RECAP' SOME OF THESE DEMONSTRATIONS BUT THEY ARE DIFFICULT TO EXPLAIN WITH JUST WORDS & DIAGRAMS SO I APOLOGISE IF SOME PARTS ARE A BIT DIFFICULT TO UNDERSTAND WITHOUT HAVING SEEN THE RELEVANT PROGRAMME. TO AVOID COMPLETE BAFFLEMENT I HAVEN'T ATTEMPTED TO 'RECAP' EVERYTHING & I'VE ALSO INCLUDED A SELECTION OF ODD FACTS ABOUT THE MACHINES, PARTICULARLY ONES THAT FINALLY GOT LEFT OUT OF THE ACTUAL PROGRAMMES.

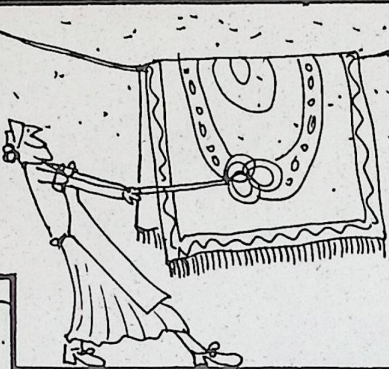
TIM HUNKIN



# ★ THE VACUUM CLEANER ★

## BEATING

BEFORE THE INVENTION OF THE VACUUM CLEANER, CARPETS & UPHOLSTERY WERE TAKEN OUTSIDE & BEATEN ONCE A YEAR TO GET THE DUST OUT (THE SPRING CLEAN). FITTED CARPETS WERE TOTALLY IMPRACTICAL

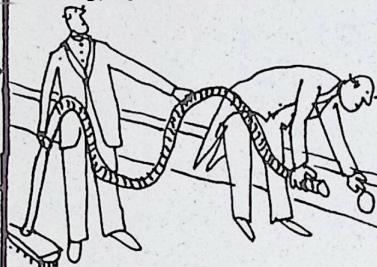


## LIFETIME DIRT

MANY PLACES HAD NEVER BEEN PROPERLY CLEANED BEFORE THE INTRODUCTION OF THE VACUUM CLEANER. ONE PARISIAN THEATRE RECORDED THAT 217 KG OF DUST WAS REMOVED FROM ITS SEATS.

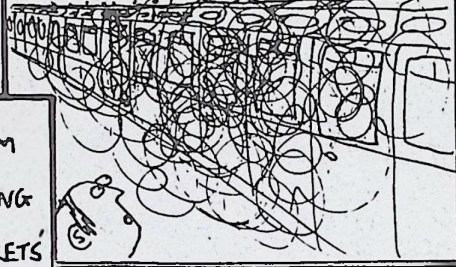
## CENTRAL SUCTION

BECAUSE THE FIRST VACUUM CLEANERS WERE SO LARGE & NOISY, SOME BUILDINGS (INCLUDING THE HOUSES OF PARLIAMENT) WERE FITTED WITH HOSE 'SOCKETS' IN EVERY ROOM LEADING TO A SINGLE GIANT VACUUM CLEANER IN THE BASEMENT.

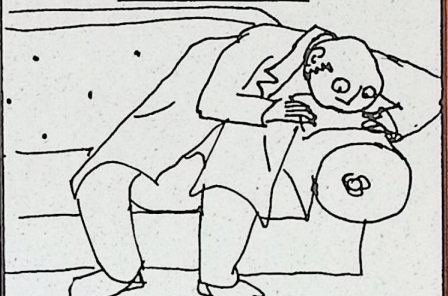


## BLOWING

THE VACUUM CLEANER WAS PROBABLY INVENTED IN 1902 BY A BRIDGE BUILDER CALLED HUBERT BOOTH. AFTER WATCHING A NOT VERY SUCCESSFUL DEMONSTRATION OF A RAILWAY CARRIAGE CLEANER THAT BLEW THE DUST OUT, HE REALISED THAT SUCKING IT WOULD WORK MUCH BETTER.



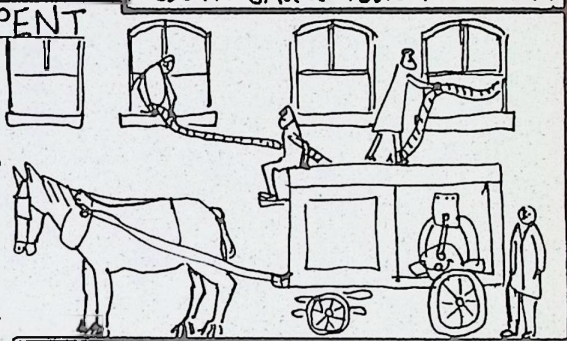
## SUCKING



BOOTH'S FIRST EXPERIMENT WAS TO PLACE A HANKY ON HIS SOFA & SUCK HARD THROUGH IT. THIS SUCKED THE DIRT OUT OF THE UPHOLSTERY, TRAPPING IT IN THE HANKY & MAKING IT FILTHY. HIS FIRST MACHINE WAS SIMPLY A CLOTH BAG & A SUCTION PUMP.

## THE NOISY SERPENT

BOOTH'S FIRST MACHINES WERE HORSE-DRAWN & WERE CONNECTED BY HOSES TO ROOMS IN THE HOUSE. THEY WERE NICK-NAMED 'NOISY SERPENTS' & BOOTH WAS OFTEN SUED FOR FRIGHTENING PASSING HORSES.



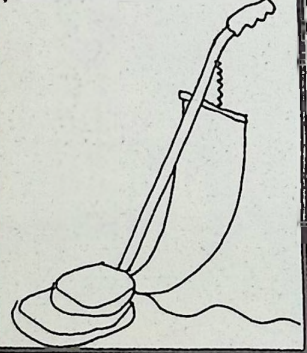
## SELLING



UNTIL THE 1950s SELLING VACUUM CLEANERS WAS NOT EASY. DIFFERENT AREAS HAD DIFFERENT VOLTAGE SUPPLIES (SOME AS LOW AS 90 VOLTS). THERE WERE NO ELECTRICAL SHOPS (CYCLE SHOPS SOMETIMES SOLD ELECTRICAL ITEMS AS A SIDELINE) SO MOST VACUUM CLEANERS WERE SOLD BY DOOR-TO-DOOR SALESMEN.

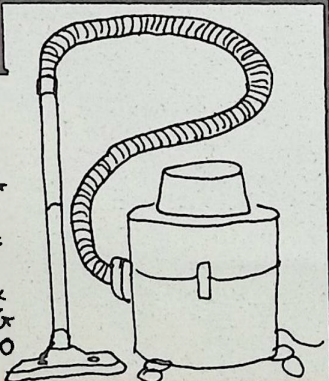
## UPRIGHT CLEANERS

UPRIGHT VACUUM CLEANERS TEND TO BE BETTER AT CLEANING CARPETS THAN OTHER TYPES BECAUSE THE ROTATING BRUSHES DISLODGE THE DIRT. BRITAIN IS THE ONLY COUNTRY IN EUROPE WHERE THEY ARE POPULAR.



## BIN CLEANERS

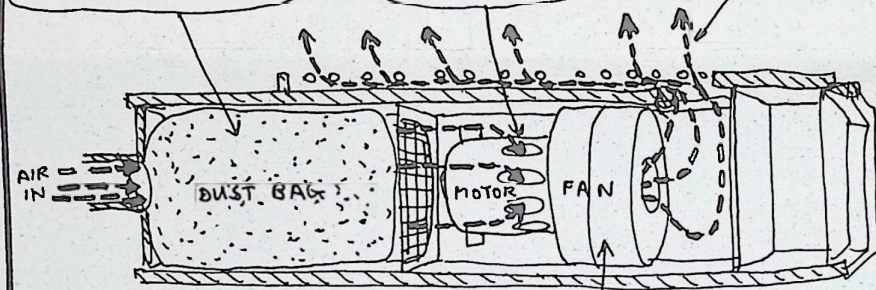
BIN TYPE VACUUM CLEANERS HAVE THE ADVANTAGE OF PICKING UP WOOD SHAVINGS & OTHER LARGE BITS & PIECES. HOWEVER, THEY TEND TO BE NOISIER & NO BETTER AT SUCKING UP DUST (ACCORDING TO WHICH MAGAZINE).



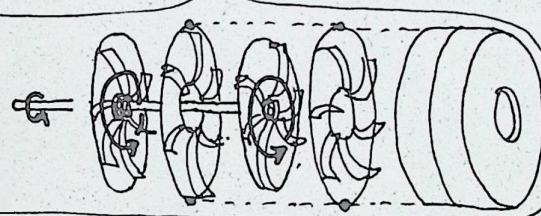
PAPER ACTS AS A FILTER TRAPPING DIRT BUT LETTING AIR PASS STRAIGHT THROUGH

AIR SUCKED THROUGH MIDDLE OF MOTOR INTO FAN

AIR BLOWN OUT THROUGH GRILLE ON TOP

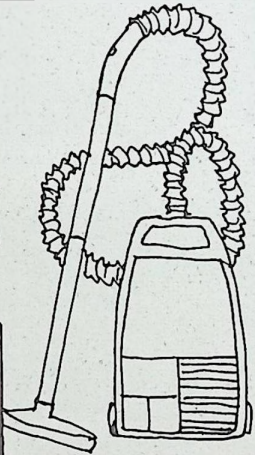


FAN HAS 2 SETS OF ROTATING VANES WHICH FLING THE AIR OUTWARDS & 2 SETS OF FIXED VANES TO CHANNEL IT BACK TO THE MIDDLE AGAIN



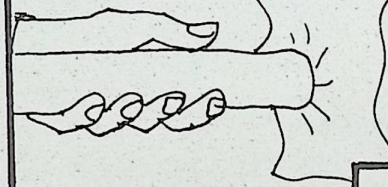
## CYLINDER CLEANERS

TRADITIONAL UPRIGHT VACUUM CLEANERS SUCK THE DIRT STRAIGHT THROUGH THE FAN - WHICH THEREFORE HAS TO BE QUITE SIMPLE & ROBUST. OTHER TYPES OF CLEANER ONLY PASS CLEAN AIR THROUGH THE FAN, SO IT CAN BE LIGHTER & MORE AERODYNAMIC.



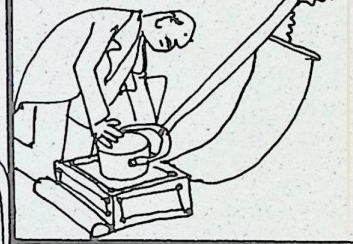
## BLOCKAGES

WHEN THE NOZZLE GETS BLOCKED UP, THE VACUUM CLEANER MOTOR ACTUALLY USES LESS POWER. WITHOUT AIR PASSING THROUGH THE FAN, THE FRICTIONAL RESISTANCE IS REDUCED. THE PITCH OF THE MOTOR NOISE RISES AS IT RUNS FASTER & FREER.



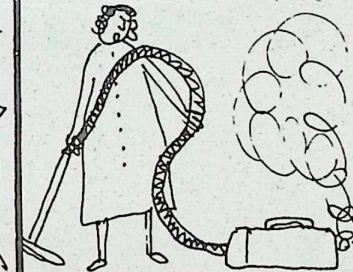
## HOOVER

W.H. HOOVER WAS A HARNESS MAKER WHOSE BUSINESS HAD BEEN HIT BY THE ADVENT OF THE CAR. HE BOUGHT THE RIGHTS TO MANUFACTURE THE FIRST ELECTRIC PORTABLE VACUUM CLEANER FROM THE CARETAKER OF A LOCAL DEPARTMENT STORE, WHO HAD PATENTED IT.



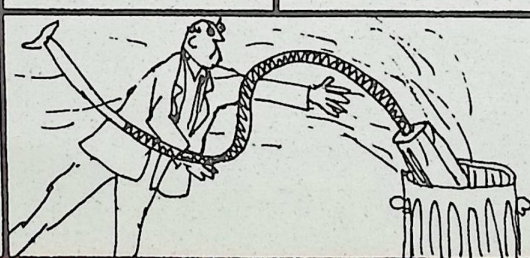
## FILTERS

THE CLOTH OR PAPER BAGS INSIDE VACUUM CLEANERS TRAP PARTICLES BIGGER THAN ABOUT .005 MM. EVERYTHING SMALLER (UP TO 15% OF HOUSEHOLD DUST) PASSES STRAIGHT THROUGH THE MACHINE & COMES OUT WITH THE EXHAUST AIR.



## MOTORS

VACUUM CLEANER MOTORS QUICKLY OVERHEAT WITHOUT THE AIR BEING SUCKED THROUGH THE MIDDLE. THEY ARE VERY POWERFUL FOR THEIR SIZE & RUN NEAR TO THEIR LIMITS SO THEY DO TEND TO LAST LESS LONG THAN MOST OTHER SORTS OF MOTOR.





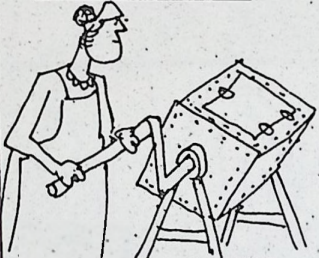
# ★ THE WASHING MACHINE ★



## HAND WASHING

ALL WASHING WORKS BY SQUASHING WATER THROUGH THE FIBRES OF THE CLOTHES. SOAP & DETERGENT HELP THE WASH ACTION BY MAKING GREASE & OIL DISSOLVE IN THE WATER & BY CARRYING AWAY THE DIRT IN THE LATHER.

## HAND-POWERED MACHINES



THE FIRST MANUAL WASHING MACHINES APPEARED IN THE 1760s. THE MOST POPULAR TYPE WERE WOODEN BOXES WHICH WERE FILLED WITH CLOTHES & WATER & ROTATED.

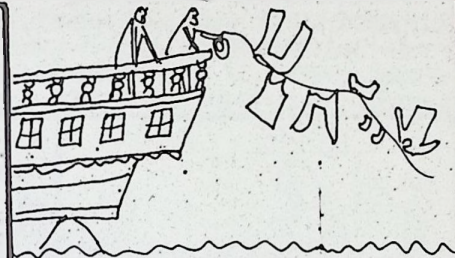
## THE DOLLY

THE FIRST STEP TOWARDS MECHANISATION WAS THE DOLLY, WHICH WAS PUMPELLED UP & DOWN IN THE WASH TUB. THIS AVOIDED THE NEED FOR BENDING OVER & GETTING WET.



## NAUTICAL AUTOMATICS

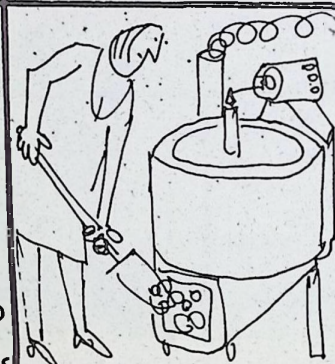
THE EARLIEST FORM OF AUTOMATIC WASHING WAS THE NAUTICAL PRACTICE OF TOWING CLOTHES BEHIND THE SHIP. THE COMBINATION OF AGITATION & A CONSTANT FLOW OF CLEAN WATER WASHES THE CLOTHES QUITE EFFECTIVELY.



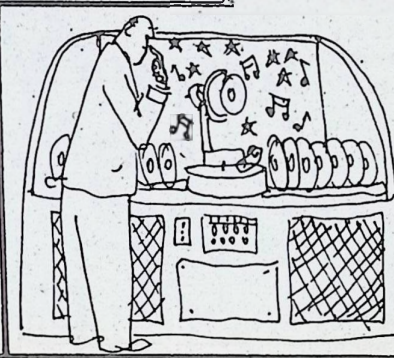
## SHOCKING MACHINES



MOTORISED MACHINES, POWERED BY ELECTRICITY, STEAM & PETROL, WERE GRADUALLY INTRODUCED. MANY ELECTRIC MACHINES OF THE 1920s HAD THE MOTOR POSITIONED UNDER THE TUB WHERE IT TENDED TO GET WET & DELIVER POWERFUL ELECTRIC SHOCKS.



**COAL-FIRED MACHINES**  
SOME ELECTRIC WASHING MACHINES OF THE 1920s HAD COAL-FIRED HEATING - A FIRE GRATE UNDERNEATH THE WASHING DRUM.

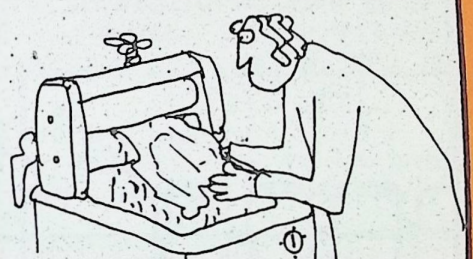


## THE AUTOMATIC

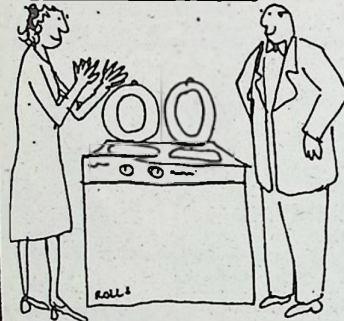
THE FIRST AUTOMATIC WAS MADE BY A U.S. COMPANY CALLED SEEBURG WHO MOSTLY MADE JUKEBOXES. THE MACHINE WAS A FAILURE BUT SEEBURG CARRIED ON MAKING PROGRAMMER TIMER SWITCHES FOR OTHER COMPANIES.

## DRYING

MOST EARLY ELECTRIC WASHERS WERE FITTED WITH WRINGERS. SOME AMERICAN MACHINES OF THE 50s HAD RUBBER TUBS WHICH COLLAPSED & SQUEEZED THE CLOTHES DRY. THE SPIN DRIER WAS INVENTED IN THE 1890s BUT DIDN'T BECOME POPULAR UNTIL THE 1950s.



## THE ROLLS



WASHING MACHINES REMAINED LUXURY PRODUCTS UNTIL THE 1960s WHEN THE ROLLS TWIN TUBS APPEARED. THE COMPANY WENT BANKRUPT IN 1964 BUT BY THEN ITS CHEAP PRICE HAD MADE WASHING MACHINES VERY POPULAR. THE ITALIANS STARTED IMPORTING THE CHEAP AUTOMATICS IN THE LATE 60s.

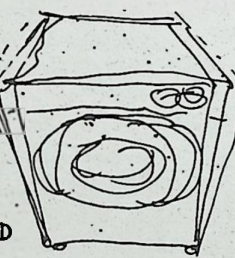
## THE WASH ACTION

IN A MODERN AUTOMATIC, THE SPEED THE DRUM GOES ROUND FOR THE WASH IS CRITICAL. THE CLOTHES SHOULD JUST GET ROUND TO THE TOP OF THE DRUM & THEN FALL. THE TUMBLING ACTION SQUASHES THE WATER THROUGH THEM. THE MACHINES NEED LOW LATHER DETERGENTS BECAUSE LATHER CUSHIONS THE TUMBLING ACTION.



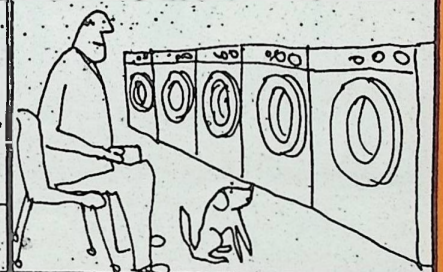
## VIBRATION

THE INERTIA OF A LOAD OF WASHING SPINNING AT FULL SPEED IS CONSIDERABLE. BOTH DRUM & MACHINE BASE NEED CONCRETE WEIGHTS TO STABILISE THEM. TO ENSURE THE CLOTHES ARE DISTRIBUTED EVENLY ROUND THE DRUM (SO THE LOAD IS BALANCED) THE SPIN SPEED IS USUALLY INCREASED GRADUALLY IN STEPS.

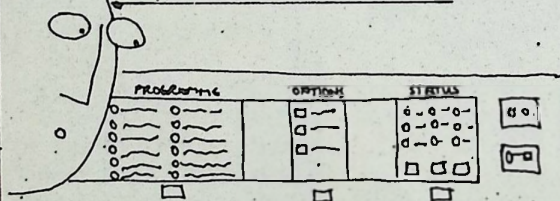


## GEAR CHANGE

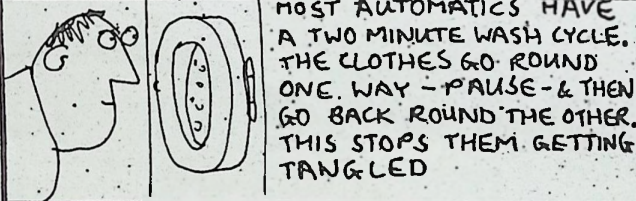
THE MOTORS ON MODERN AUTOMATICS CHANGE GEAR, FROM WASH TO SPIN, ELECTRONICALLY BUT THE FIRST AUTOMATICS HAD TO HAVE MECHANICAL GEARBOXES. LAUNDRETTE MACHINES STILL HAVE THEM - YOU CAN HEAR THE CLUNK AS THEY CHANGE GEAR.



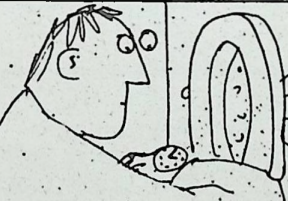
## MICROPROCESSORS



AUTOMATICS WITH MICROPROCESSORS BEGAN APPEARING ABOUT 5 YEARS AGO (THESE MACHINES HAVE LOTS OF PUSH BUTTONS INSTEAD OF A DIAL PROGRAMME SWITCH). HOWEVER THE OLD DIAL SWITCHES (ELECTROMECHANICAL) ARE STILL CHEAPER & FITTED TO MOST MACHINES TODAY.

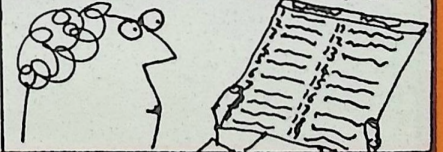


FOR SYNTHETIC FABRICS A GENTLER WASH IS ACHIEVED BY HALVING THE ROTATING TIME & DOUBLING THE TIME OF THE PAUSES.

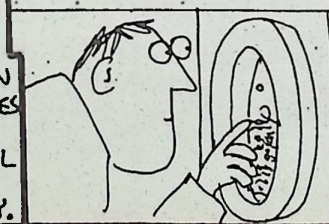


## COMPLEXITY

ALTHOUGH AUTOMATICS HAVE UP TO 20 DIFFERENT WASH PROGRAMMES THEY ARE ALL JUST COMBINATIONS OF THE 3 WASH ACTIONS (SEE LEFT) & DIFFERENT TEMPERATURES.



THE GENTLEST WASH ACTION, FOR WOOL, IS ACHIEVED BY SIMPLY LETTING MORE WATER INTO THE DRUM. THIS CUSHIONS THE CLOTHES AS THEY TUMBLE OVER EACH OTHER.

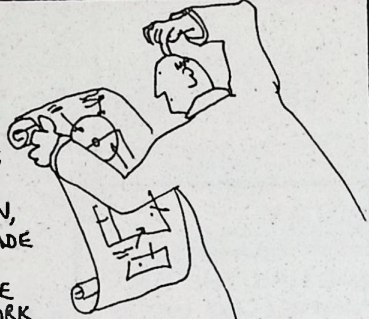




# ★ THE SEWING MACHINE ★

## SAINT

THE FIRST PATENT FOR A SEWING MACHINE WAS TAKEN OUT BY AN ENGLISH CABINETMAKER CALLED THOMAS SAINT IN 1790. IT'S DOUBTFUL WHETHER HE ACTUALLY BUILT HIS DESIGN, BECAUSE, WHEN ONE WAS MADE FROM HIS DRAWINGS 100 YEARS LATER, IT HAD TO BE EXTENSIVELY MODIFIED TO WORK.



## THIMMONIER

THE FIRST MAN TO USE A SEWING MACHINE PRACTICALLY WAS A FRENCH TAILOR CALLED THIMMONIER. HE PATENTED A MACHINE IN 1830 & INTRODUCED 80 MACHINES TO A FACTORY PRODUCING MILITARY UNIFORMS. AN ANGRY MOB OF HAND SEWERS (WHO SAW THE MACHINE AS A THREAT TO THEIR LIVELIHOOD) BROKE INTO THE FACTORY & SMASHED THE MACHINES. THIMMONIER FLED & DIED IN POVERTY IN 1857.



## HOWE



THE INVENTION OF THE MODERN SEWING MACHINE IS OFTEN CREDITED TO ELIAS HOWE. IN 1853 HE SUED ALL THE U.S. MACHINE MANUFACTURERS, CLAIMING THAT THEIR MACHINES WERE DERIVED FROM HIS PROTOTYPE, PATENTED IN 1847. HE WON HIS CASE, WAS AWARDED A ROYALTY OF \$25 PER MACHINE & BECAME RICH OVERNIGHT.

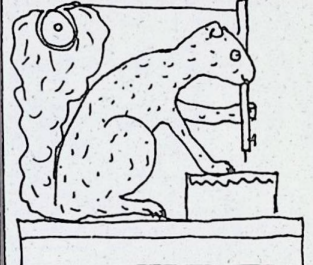
## SINGER

ISAAC MERRITT SINGER, BORN IN 1811, WAS TRAINED AS A MECHANIC BUT WAS ATTRACTED BY THEATRICAL LIFE. WITH \$2000 FROM THE PATENT RIGHTS OF HIS FIRST INVENTION (AN EXCAVATOR), HE SET UP A THEATRE COMPANY CALLED THE MERRITT PLAYERS. THIS SOON WENT BANKRUPT & THEN, IN 1850, SINGER CAME ACROSS AN EARLY SEWING MACHINE. CONVINCED HE COULD DO BETTER HE BUILT HIS OWN & WITHIN A YEAR HAD STARTED PRODUCTION. THE SUCCESS OF HIS MACHINES WAS LARGELY DUE TO HIS THEATRICAL FLAIR. HE NEVER TIRED OF DEMONSTRATING THEM - EVEN AT CIRCUSES.



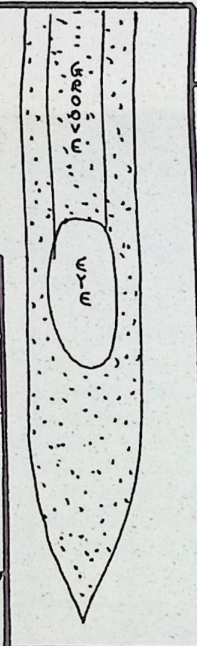
## DECORATION

IN THE 1860s IT BECAME FASHIONABLE TO DECORATE THE MACHINES. SOME WERE EVEN CAST IN THE SHAPES OF LIONS & SQUIRRELS TO DISGUISE THEIR FUNCTIONAL NATURE.

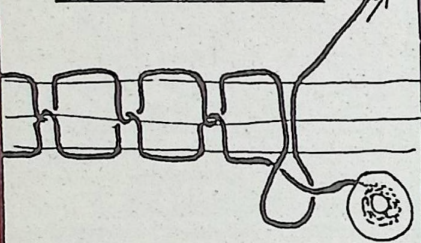


## THE NEEDLE

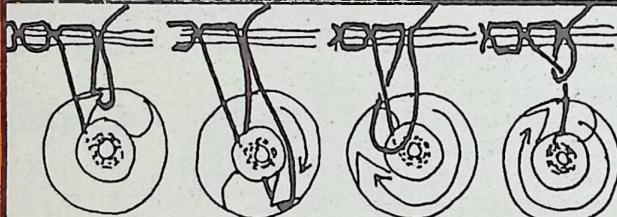
THE KEY TO THE SEWING MACHINE IS REALLY THE SHAPE OF THE NEEDLE. WHEN STABBED THROUGH THE MATERIAL & PULLED OUT AGAIN THE THREAD SLIPS THROUGH THE GROOVE, AUTOMATICALLY LEAVING A LOOP BELOW.



## THE STITCH

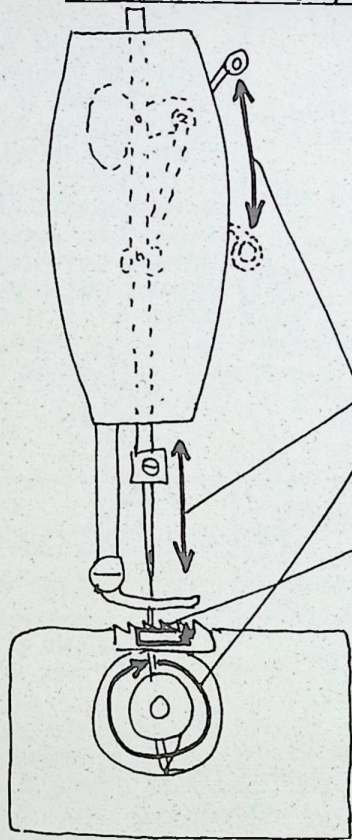


TO FORM THE STITCH A SECOND REEL OF THREAD SIMPLY HAS TO PASS THROUGH THE LOOP, WHICH IS THEN PULLED TIGHT.



UNDER THE TABLE THE SECOND REEL OF THREAD NEVER MOVES. INSTEAD THE LOOP IS PICKED UP BY A ROTATING HOOK THAT PULLS IT RIGHT UNDER THE REEL.

## THE MECHANISM



**THE THREAD**  
ONE PROBLEM FACED BY THE FIRST MACHINES WAS THE FREQUENT BREAKAGE OF THE THREADS. 6 CORD MACHINE THREADS FINALLY SOLVED THE PROBLEM IN THE 1860s.

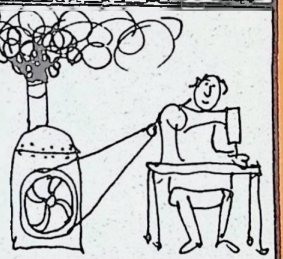
## THE TREADLE

THE TREADLE, INVENTED IN AMERICA IN THE 1850s, HAD THE BIG ADVANTAGE OF LEAVING BOTH HANDS FREE TO CONTROL THE CLOTH. BUT IN BRITAIN IT WAS REGARDED WITH GREAT SUSPICION UNTIL THE 20TH CENTURY. THE ACTION WAS THOUGHT TO BE UNLADYLIKE & HARMFUL TO THE ANKLES.



## POWER

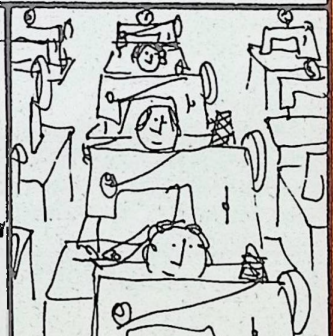
VARIOUS OTHER POWER SOURCES WERE TRIED, INCLUDING GIANT CLOCKWORK MOTORS, WATERWHEELS & STEAM. THE FIRST ELECTRIC MACHINES APPEARED IN THE 1920s.



- 1. THE NEEDLE IS PUSHED THROUGH THE MATERIAL
- 2. THE THREAD LOOP IS PULLED ROUND THE BOBBIN
- 3. THE STITCH IS PULLED TIGHT
- 4. THE MATERIAL IS MOVED FORWARD

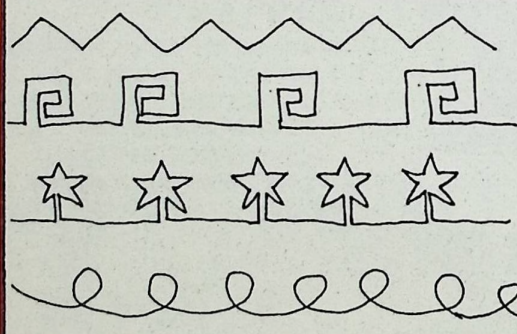
## BREAKING

SINGER USED TO HAVE A POLICY OF BREAKING UP ANY MACHINES TAKEN IN PART EXCHANGE, TO REDUCE THE SUPPLY OF SECOND-HAND MACHINES.



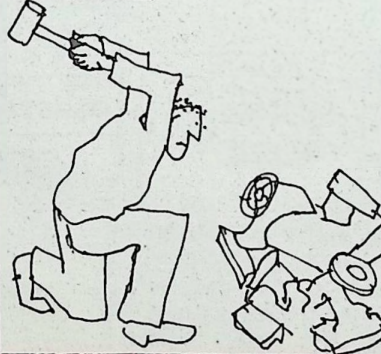
## FANCY STITCHES

MOST MODERN MACHINES DO ALL SORTS OF FANCY STITCHES, BUT THEY ONLY NEED ONE EXTRA MECHANISM - TO MOVE THE NEEDLE SIDWAYS. COMBINATIONS OF THIS MOVEMENT WITH VARIABLE CLOTH FEED MOVEMENTS MAKE ALL THE STITCHES POSSIBLE.



## HIGH-SPEED

INDUSTRIAL SEWING MACHINES CAN DO UP TO 5000 STITCHES A MINUTE (DOMESTIC ONES HAVE A MAXIMUM OF ABOUT 1500). THEY GO SO FAST THAT THE MECHANISM HAS TO SIT IN A SUMP OF OIL (JUST LIKE A CAR ENGINE).

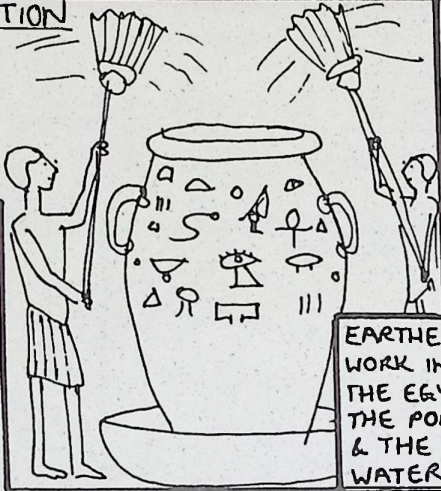




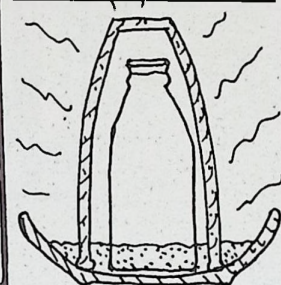
# ★ THE REFRIGERATOR ★

## EGYPTIAN REFRIGERATION

THE EARLIEST METHOD OF ARTIFICIAL COOLING COMES FROM ANCIENT EGYPT, WITH RECORDS OF SLAVES BEING EMPLOYED TO FAN EARTHENWARE POTS.



## MILK COOLERS



EARTHENWARE MILK COOLERS WORK IN THE SAME WAY AS THE EGYPTIANS' POTS. - KEEP THE POROUS POTTERY WET & THE EVAPORATION OF THE WATER KEEPS THE MILK COOL.

## EVAPORATION & COOLING

IN A LIQUID, THE ATOMS & MOLECULES ARE MUCH CLOSER TOGETHER THAN IN A GAS. TO CHANGE THE LIQUID TO A GAS, ENERGY IS NEEDED TO OVERCOME THE FORCES THAT ATTRACT THE ATOMS & MOLECULES TOGETHER. IT IS THIS ENERGY, IN THE FORM OF HEAT, THAT IS EXTRACTED FROM THE SURROUNDINGS & PRODUCES THE COOLING EFFECT OF EVAPORATION.

GAS

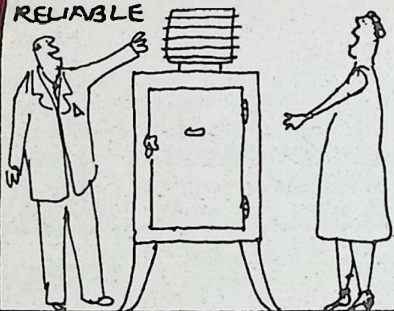
LIQUID

## LIQUIDS & GASES

THE BOILING POINT OF GASES RISES WITH AN INCREASE IN PRESSURE, SO MANY SUBSTANCES THAT ARE NORMALLY GASES AT ROOM TEMPERATURE WILL BECOME LIQUIDS IF THEY ARE COMPRESSED. WHEN THE PRESSURE IS RELEASED THE LIQUID RAPIDLY EVAPORATES BACK TO A GAS.

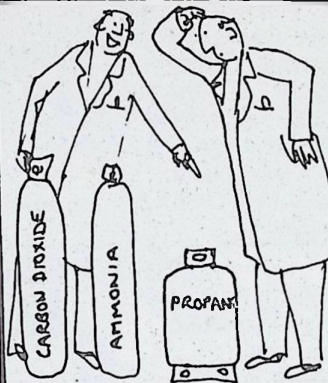
## ODOURLESS FRIDGES

EARLY FRIDGES TENDED TO LEAK & BE VERY SMELLY, THE SOLUTION INTRODUCED BY G.E.C. IN 1926, WAS TO ENCLOSE THE COMPRESSOR & MOTOR AS AN AIR-TIGHT UNIT SEALED FOR LIFE, ALL DOMESTIC FRIDGES HAVE BEEN BUILT LIKE THIS EVER SINCE & IT'S HAD THE EFFECT OF MAKING THEM UNUSUALLY RELIABLE

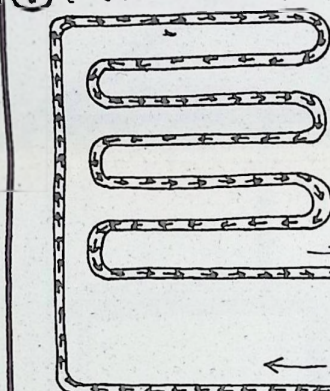


## ICE-COLD LAGER

COMMERCIAL REFRIGERATION EQUIPMENT WAS FIRST DEVELOPED IN AUSTRALIA (WHERE THE WINTERS WEREN'T COLD ENOUGH TO PRODUCE MUCH NATURAL ICE). A BREWERY WAS THE FIRST COMPANY TO COMMISSION AN ARTIFICIAL ICE MAKING PLANT (IN 1865) SO COOLING AUSTRALIAN LAGER WAS THE FIRST USE OF ARTIFICIAL REFRIGERATION.



## CONDENSER PIPES (AT BACK OF FRIDGE)

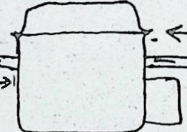


## EVAPORATOR (ICE BOX INSIDE FRIDGE)



## RESTRICTION VALVE

## SEALED COMPRESSOR (IN BOTTOM OF FRIDGE)



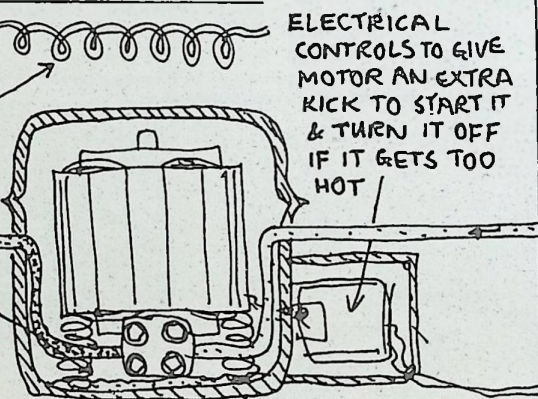
## THE FRIDGE CYCLE

- 1 THE LIQUID UNDER PRESSURE ESCAPES THROUGH THE RESTRICTION VALVE.
- 2 AS IT EVAPORATES TO A GAS THE PIPES GET VERY COLD.
- 3 THE GAS IS PIPED BACK TO A PUMP, WHERE IT GETS COMPRESSED & HEATED.
- 4 THE GAS, NOW HOT, COOLS & CONDENSES BACK TO A LIQUID, STILL UNDER PRESSURE.

## THE SEALED COMPRESSOR

AS A RESTRICTION (SEE ABOVE RIGHT) FRIDGES HAVE A LENGTH OF FINE CAPILLARY TUBE. THE LONGER THE TUBE, THE GREATER THE RESTRICTION.

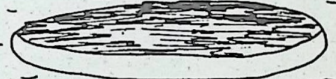
COMPRESSOR & MOTOR MOUNTED ON SPRINGS SITTING IN AN OIL BATH



ELECTRICAL CONTROLS TO GIVE MOTOR AN EXTRA KICK TO START IT & TURN IT OFF IF IT GETS TOO HOT

## REFRIGERANTS

ALMOST ANY GAS WITH A BOILING POINT OF ABOUT -30°C CAN WORK AS A REFRIGERANT, BUT MOST ARE TOO TOXIC, CORROSIVE OR INFLAMMABLE. TODAY MOST REFRIGERANTS ARE FLUOROCARBONS SIMILAR TO THE PROPELLANTS USED IN AEROSOL CANS, THE CHEMICALS WHICH ARE MAKING THE HOLE IN THE OZONE LAYER.



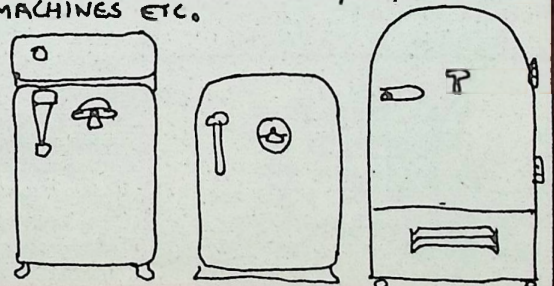
## MAGNETIC DOORS



TO PREVENT ANY COLD AIR LEAKING OUT, FRIDGES HAVE A FLEXIBLE MAGNETIC STRIP INSIDE THE RUBBER DOOR SEAL. THIS PULLS THE RUBBER INTO CONTACT WITH THE FRAME TO FORM AN AIRTIGHT SEAL ALL THE WAY ROUND.

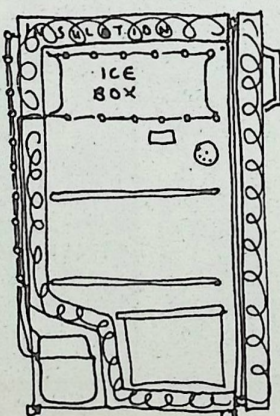
## CONVERGING DESIGNS

DIFFERENT MANUFACTURERS' FRIDGES USED TO HAVE VERY DISTINCTIVE FEATURES & APPEARANCES BUT TODAY THEY ALL LOOK ALMOST IDENTICAL. THIS IS PARTLY BECAUSE THEY ARE NO LONGER SUCH STATUS SYMBOLS & PARTLY BECAUSE THE DESIGN 'CONVERGENCE' IS A NATURAL PROCESS THAT HAPPENS TO MOST INVENTIONS - CARS/HI-FI/WASHING MACHINES ETC.



## INSULATION

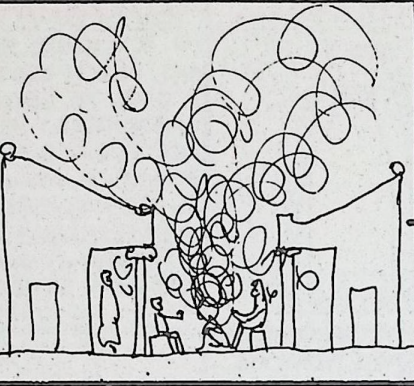
ALL FRIDGES ARE SURROUNDED BY A 1-2" THICK BLANKET OF INSULATION USUALLY A PLASTIC FOAM OR FIBREGLASS. THE PRINCIPLE OF THESE MATERIALS IS TO TRAP AS MUCH AIR AS POSSIBLE BECAUSE AIR IS A BETTER INSULATOR THAN ALMOST ANY SOLID MATERIAL.





# ★ CENTRAL HEATING ★

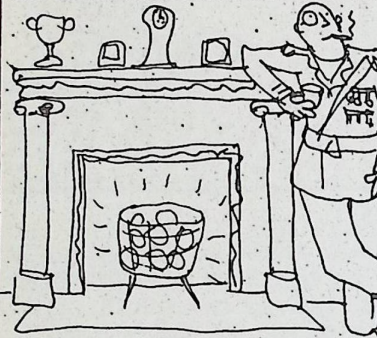
**ROMAN SMOKE**  
AT FIRST ROMAN HOUSES SIMPLY HAD A FIRE IN THE MIDDLE OF THE LIVING ROOM (THE LATIN FOR HEARTH IS FOCUS), BUT THEY PROBABLY HAD TROUBLE WITH SMOKE AS THE LATIN FOR 'LIVING ROOM' IS ATRIUM FROM ATER MEANING BLACK.



**ROMAN COMFORT**  
BY ABOUT 400AD THE ROMANS HAD PERFECTED A FORM OF CENTRAL HEATING THE FIRE WAS LIT OUTSIDE IN A FURNACE WITH HOT AIR DUCTS UNDER THE FLOORS & IN THE WALLS.



## DANISH CANNONBALLS



UNTIL 1900 THE ENTIRE DANISH WAR OFFICE WAS HEATED FROM A SINGLE FURNACE IN THE BASEMENT. THIS HEATED CANNONBALLS WHICH WERE THEN CARRIED TO EVERY ROOM & SET IN THE FIREPLACES RED HOT.

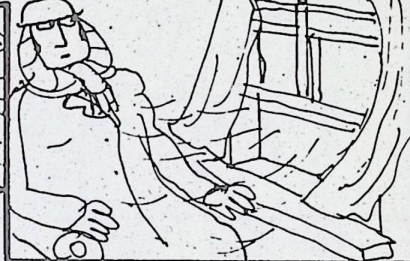
## 18TH CENTURY

TROPICAL GREENHOUSES CAME INTO FASHION IN STately HOMES IN THE LATE 18TH CENTURY. AN EVEN, SMOKE-FREE HEAT WAS REQUIRED FOR THE PLANTS & FROM THIS DEVELOPED TODAY'S CENTRAL HEATING SYSTEMS USING PIPES & RADIATORS.



## VICTORIAN MASOCHISM

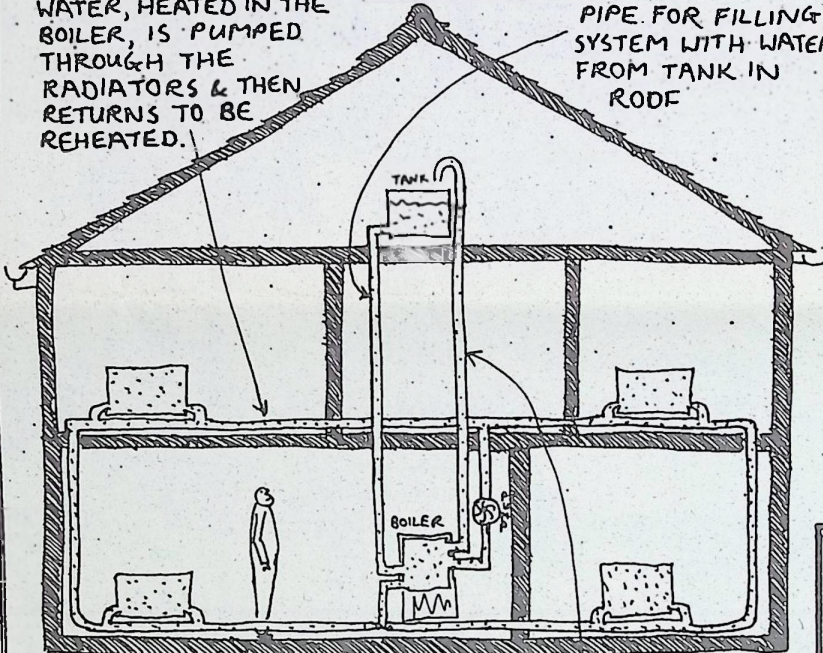
THE VICTORIANS WERE CONVINCED THAT COLD AIR WAS MORE HEALTHY THAN WARM AIR. MANY SYSTEMS WERE PATENTED FOR INTRODUCING FRESH AIR WITHOUT UNDUE DRAUGHTS. SYLVESTER'S SYSTEM WAS THOUGHT TO BE THE BEST. FRESH AIR FROM THE TOP OF A 30FT HIGH TOWER WAS PIPED TO VENTS IN EVERY ROOM.



## PIPES & RADIATORS

WATER, HEATED IN THE BOILER, IS PUMPED THROUGH THE RADIATORS & THEN RETURNS TO BE REHEATED.

PIPE FOR FILLING SYSTEM WITH WATER FROM TANK IN ROOF



BOILER IS AN INACCURATE NAME AS THE WATER IS NEVER INTENDED TO BOIL.

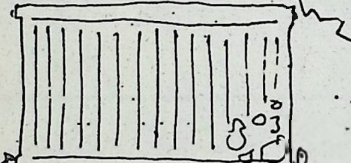
VENT PIPE TO LET WATER INSIDE EXPAND AS IT HEATS UP

## GAS HEATING



GAS WAS FIRST USED ONLY FOR LIGHTING. IN 1855 PROFESSOR ROBERT WILHELM VON BUNSEN DISCOVERED THE EFFECT OF MIXING AIR WITH THE GAS BEFORE IT WAS BURNED. IN HIS BUNSEN BURNER AIR IS SUCKED IN THE SIDE, RAISING THE TEMPERATURE OF THE FLAME & MAKING GAS A PRACTICAL SOURCE OF HEAT.

## CORROSION



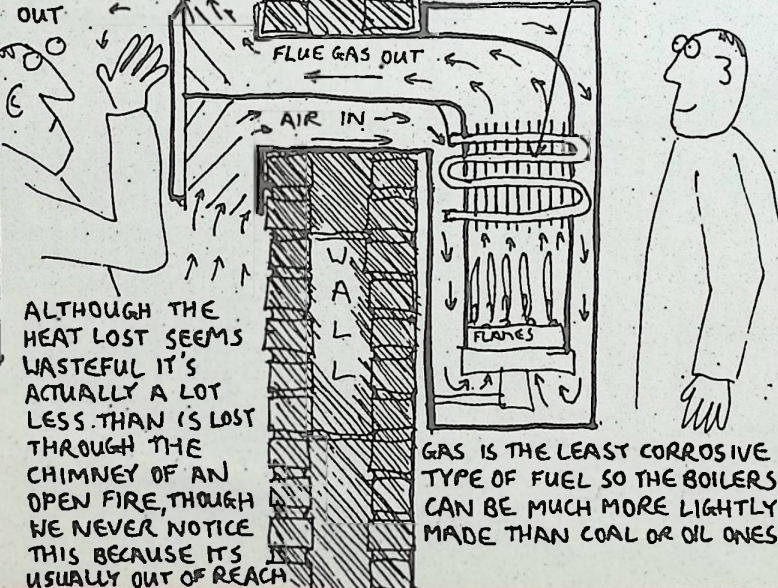
MAINS WATER IS NEVER COMPLETELY PURE & INSIDE A CENTRAL HEATING SYSTEM, CAN BE QUITE CORROSIVE. SCALE & AIR CAN BUILD UP INSIDE & ELECTROCHEMICAL REACTIONS CAN ROT AWAY BRASS FITTINGS & GENERATE HYDROGEN & OXYGEN.



## THE GAS BOILER

WHATEVER THE WIND OUTSIDE, THE PRESSURE OF THE AIR GOING IN ALWAYS BALANCES THE GASES COMING OUT

GAS BOILERS ARE COMPACT BECAUSE THERE'S ONLY EVER A SMALL AMOUNT OF WATER IN THEM RUNNING THROUGH PIPES ABOVE THE FLAMES.



ALTHOUGH THE HEAT LOST SEEMS WASTEFUL IT'S ACTUALLY A LOT LESS THAN IS LOST THROUGH THE CHIMNEY OF AN OPEN FIRE, THOUGH WE NEVER NOTICE THIS BECAUSE IT'S USUALLY OUT OF REACH

GAS IS THE LEAST CORROSIVE TYPE OF FUEL SO THE BOILERS CAN BE MUCH MORE LIGHTLY MADE THAN COAL OR OIL ONES.

## FUELS

ELECTRICITY FOR LIFE

HIGH SPEED GAS

COAL FOR A REAL FIRE

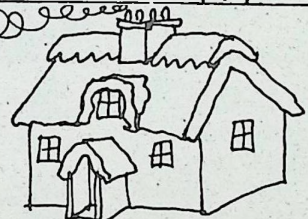
CENTRAL HEATING OF HOUSES DIDN'T START TO BECOME POPULAR UNTIL THE 1930S. THE EARLY SYSTEMS WERE ALL COAL FIRED. TODAY COAL, GAS, OIL & ELECTRICITY COMPETE BUT, UNTIL RECENTLY, GAS HAS BEEN THE CHEAPEST & IS NOW THE MOST COMMON.

## INSULATION



THE SIMPLEST & MOST EFFECTIVE INSULATION IS ROOF INSULATION. DOUBLE GLAZING IS ALSO QUITE EFFECTIVE SIMPLY BECAUSE IT ALSO STOPS DRAUGHTS WHICH CAN CAUSE A GREATER HEAT LOSS THAN EVERYTHING ELSE PUT TOGETHER.

## SIMPLICITY



MANY TRADITIONAL HOUSES WERE ENERGY EFFICIENT. THEY HAD INSULATED ROOFS - THATCH, WERE GENERALLY BUILT FACING SOUTH, COMPLETE WITH PORCHES TO REDUCE DRAUGHTS. THEY EVEN HAD A SORT OF CENTRAL HEATING - THEIR MASSIVE CENTRAL CHIMNEY BLOCKS. THESE ACTED AS GIANT STORAGE RADIATORS WARMING THE WHOLE HOUSE FROM THE FIRE.



# ★ THE TELEVISION SET ★

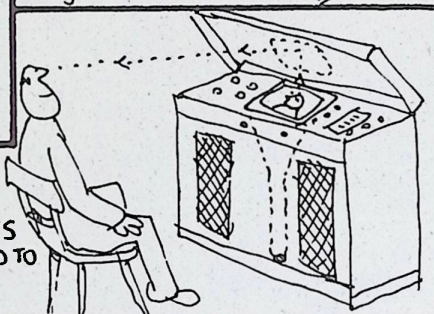
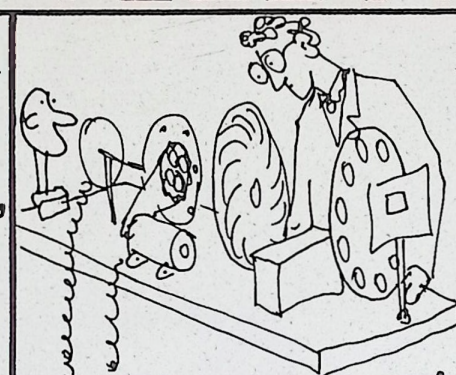
## ELECTRIC VISION

THE FIRST ATTEMPTS TO CREATE DEVICES FOR 'SEEING WITH ELECTRICITY' CAME IN THE 1870s, FOLLOWING BELL'S DISCOVERY OF THE TELEPHONE (SPEAKING WITH ELECTRICITY), & THE DISCOVERY OF THE FIRST LIGHT-SENSITIVE ELECTRICAL CONDUCTOR - SELENIUM. NONE OF THESE EARLY ATTEMPTS WAS SUCCESSFUL.



## MIRROR VIEWING

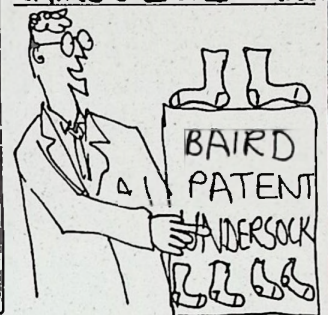
THE TUBES ON THE FIRST ELECTRONIC TELEVISION SETS WERE SO LONG THAT THEY HAD TO BE MOUNTED VERTICALLY & VIEWED VIA A MIRROR.



## LOGIE BAIRD V E.M.I.

JOHN LOGIE BAIRD, THE SCOTTISH INVENTOR, DEVELOPED AN ELECTROMECHANICAL TV SYSTEM IN THE 1920s & GAVE FREQUENT PUBLIC DEMONSTRATIONS. THE PUBLICITY ENCOURAGED E.M.I. TO DEVELOP A PRACTICAL ALL-ELECTRONIC SYSTEM, SIMILAR TO TODAY'S. IN 1936, THE BBC TRANSMITTED BOTH SYSTEMS. BUT EMI'S WAS JUDGED SUPERIOR.

## BAIRD'S ENTERPRISES

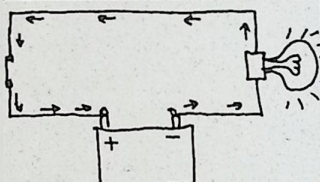


AMONGST BAIRD'S OTHER ENTERPRISES WERE HIS PATENT UNDERSOCKS, AN ATTEMPT TO START A JAM FACTORY IN TRINIDAD & AN ATTEMPT TO MAKE ARTIFICIAL DIAMONDS, WHICH BLACKED OUT A LARGE PART OF GLASGOW.

## INSULATION

PLASTIC INSULATION MATERIALS ONLY BECAME WIDELY AVAILABLE DURING THE 1940s. ALL THE EARLY SETS USED RUBBER, WHICH PERISHED; CLOTH, WHICH COULD ABSORB WATER; & TAR WHICH EASILY MELTED.

## ELECTRONS

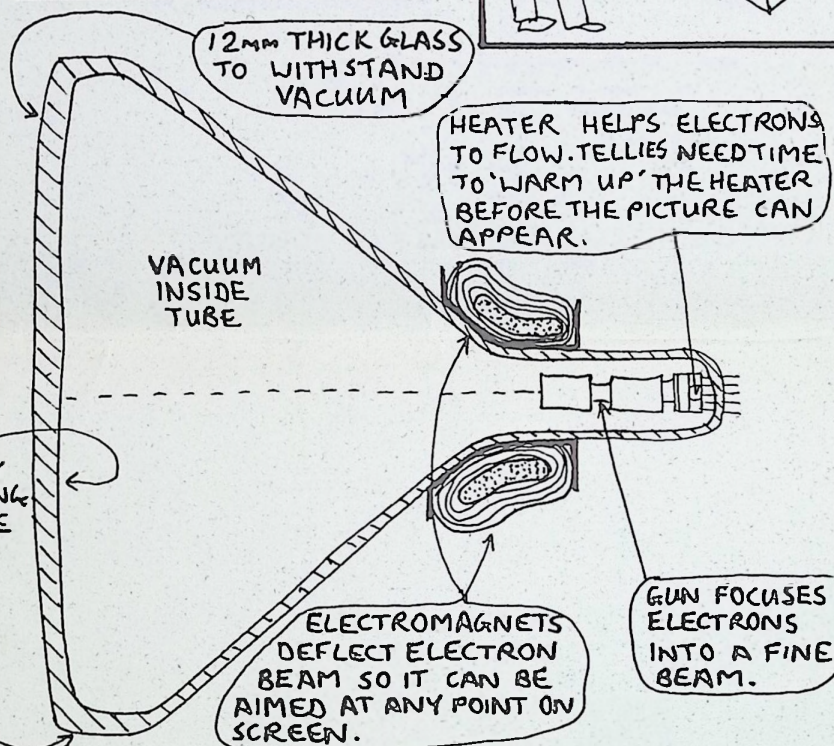


ELECTRIC CURRENT IS A FLOW OF ELECTRONS. ALTHOUGH IT NORMALLY FLOWS THROUGH WIRES, INSIDE THE T.V. TUBE IT ACTUALLY FLOWS THROUGH 'SPACE' FROM THE GUN TO THE SCREEN (SEE RIGHT).

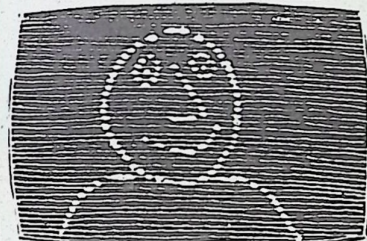
LAYER OF PHOSPHORS WHICH GLOW WHEN HIT BY ELECTRON BEAM, CREATING A SPOT OF LIGHT ON THE SCREEN

HIGH VOLTAGE BETWEEN GUN & SCREEN ATTRACTS ELECTRONS ACROSS

## THE PICTURE TUBE

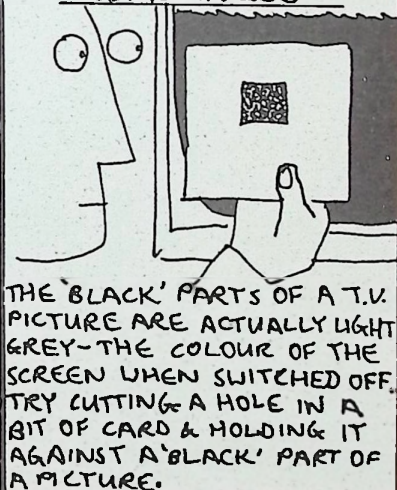


## SCANNING



THE SPOT OF LIGHT CREATED BY THE ELECTRONS IS MADE TO SCAN THE SCREEN IN A SERIES OF LINES. BY VARYING THE BRIGHTNESS OF THE SPOT AS IT SCANS, THE ILLUSION OF A BLACK & WHITE PICTURE IS CREATED.

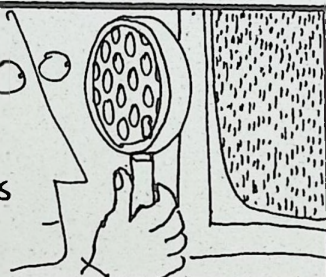
## BLACKNESS



THE 'BLACK' PARTS OF A T.V. PICTURE ARE ACTUALLY LIGHT GREY - THE COLOUR OF THE SCREEN WHEN SWITCHED OFF. TRY CUTTING A HOLE IN A BIT OF CARD & HOLDING IT AGAINST A 'BLACK' PART OF A PICTURE.

## COLOUR

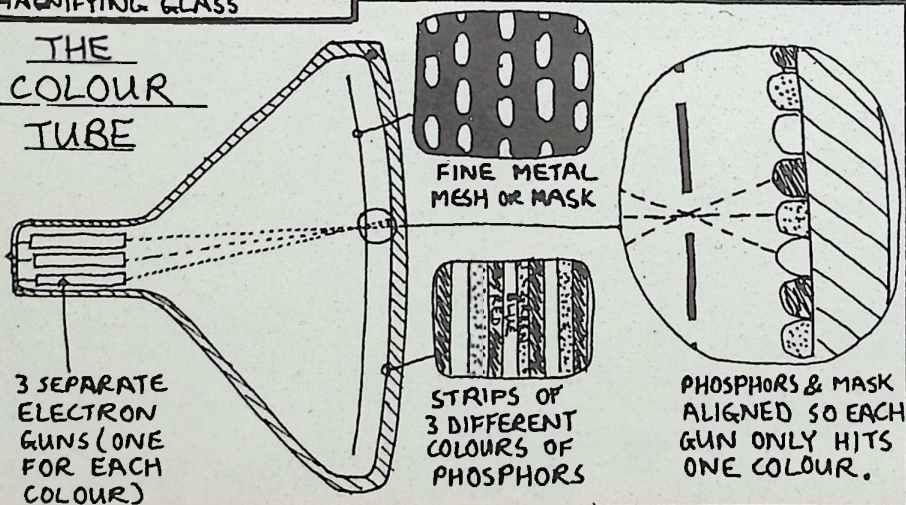
THE SCREEN OF A COLOUR TELE IS MADE UP OF RED, GREEN & BLUE SPOTS. EVERY COLOUR, INCLUDING WHITE, IS ACTUALLY CREATED BY JUST VARYING THE BRIGHTNESS OF THE THREE. YOU CAN SEE THIS BY LOOKING AT THE SCREEN THROUGH A MAGNIFYING GLASS



## SPEED

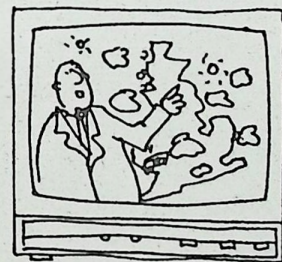
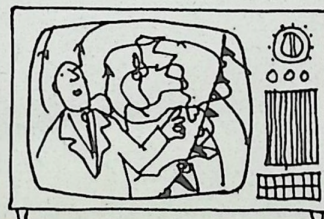
THE SPOT OF LIGHT SCANS THE ENTIRE SCREEN 25 TIMES EVERY SECOND. ON A 26" TELE THE SPOT OF LIGHT ACTUALLY TRAVELS AT ABOUT 22,000 MPH.

## THE COLOUR TUBE



## MODERN TELEVISIONS

USING INTEGRATED CIRCUITS, MODERN TELLIES HAVE LESS THAN HALF THE NUMBER OF PARTS OF A 15-YEAR-OLD ONE



MODERN TELLIES ALSO USE ABOUT HALF AS MUCH ELECTRICITY AS 15-YEAR-OLD ONES.



# FURTHER READING

- MECHANISATION TAKES COMMAND  
SIEGFRIED GIDEON  
CHICAGO PRESS
  - OBJECTS OF DESIRE  
ADRIAN FORTY  
THAMES & HUDSON
  - A HISTORY OF TECHNOLOGY VOLS 4 TO 6  
SINGER, HOLMYARD, HALL & WILLIAMS  
OXFORD UNIVERSITY PRESS
  - HOW IT WORKS  
MARSHALL CAVENDISH PART-WORK
  - HOW THINGS WORK  
FALLADIN
  - EVERYDAY INVENTIONS  
MEREDITH HOOPER  
ANGUS & ROBERTSON
  - ELECTRICAL APPLIANCES  
SPARKE  
UNWIN HYMAN
  - 100 YEARS OF HOUSEHOLD APPLIANCES  
ZANUSSI (BOOKLET)
  - THE SEWING MACHINE, ITS INVENTION & DEVELOPMENT  
ROGERS COOPER  
SMITHSONIAN INSTITUTE
  - HOME FIRES BURNING  
LAURENCE WRIGHT  
ROUTLEDGE & KEGAN PAUL
  - CENTRAL HEATING  
STEELE  
NEWNES
  - TELEVISION, THE FIRST 50 YEARS  
BUSSEY & GEDDES  
NATIONAL MUSEUM OF PHOTOGRAPHY, BRADFORD
  - THE WASHING MACHINE MANUAL  
DIXON  
HAYNES
  - BASIC COLOUR TELEVISION, PART ONE  
COLE  
TECHNICAL PRESS
- THERE IS ALSO A COMPLETE ENCYCLOPEDIA •  
BY TIM HUNKIN CALLED  
'ALMOST EVERYTHING THERE IS TO KNOW'  
(PYRAMID)

